



NASA INNOVATIVE ADVANCED CONCEPTS

NASA Innovative Advanced Concepts Program (NIAC)

Advanced Space Propulsion Workshop

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What is **NIAC**?

NASA Innovative Advanced Concepts

NASA Innovative Advanced Concepts

A program to support
early studies of
innovative, yet
credible, visionary
concepts
that could one day
“change the possible”
in aerospace.



NIAC Awards & Scope

PHASE I Research	PHASE II Research
<ul style="list-style-type: none"> • Up to \$100K • ~ 9 months for concept definition and initial analysis in a mission context 	<ul style="list-style-type: none"> • Up to \$500K • ~ 2 years for further development of most promising Phase I concepts, comparative mission analysis, pathways forward, spin off technologies

Scope of NIAC Studies:

- Aerospace *architecture, mission, or system* concepts (not focused tech.)
- Exciting: offering a potential breakthrough or revolutionary improvement
- Unexplored: novel, with basic feasibility and properties unclear
- Credible: sound scientific/engineering basis and plausible implementation

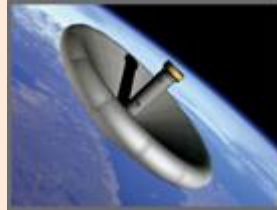


Space Tech Portfolio

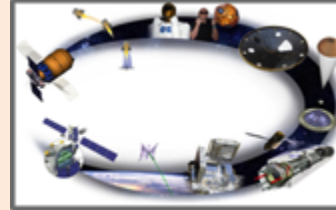
Space Technology Mission Directorate (STMD) Programs



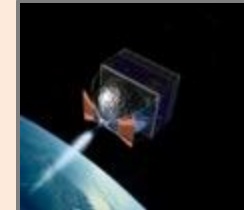
Transformative &
Crosscutting
Technology
Breakthroughs



**Game Changing
Development (GCD)**



**Technology
Demonstration
Missions (TDM)**



**Small Spacecraft
Technologies (SSTP)**

Pioneering
Concepts/
Developing
Innovation
Community



**Space Technology
Research Grant (STRG)**



**NASA Innovative
Advanced Concepts
(NIAC)**



**Center Innovation
Fund (CIF)**

Creating Markets &
Growing Innovation
Economy



Centennial Challenges



**Small Business Innovation
Research & Small Business
Technology Transfer (SBIR/STTR)**



**Flight Opportunities
Program**

NIAC Program Personnel



- **Dr. Jay Falker**
Program Executive
- **Jason Derleth**
Program Manager
- **Dr. Ron Turner**
Senior Science Advisor
- **Kathy Reilly**
Strategic Partnerships Manager
- **Barbara Mader**
NIAC Budget Analyst



NIAC External Council



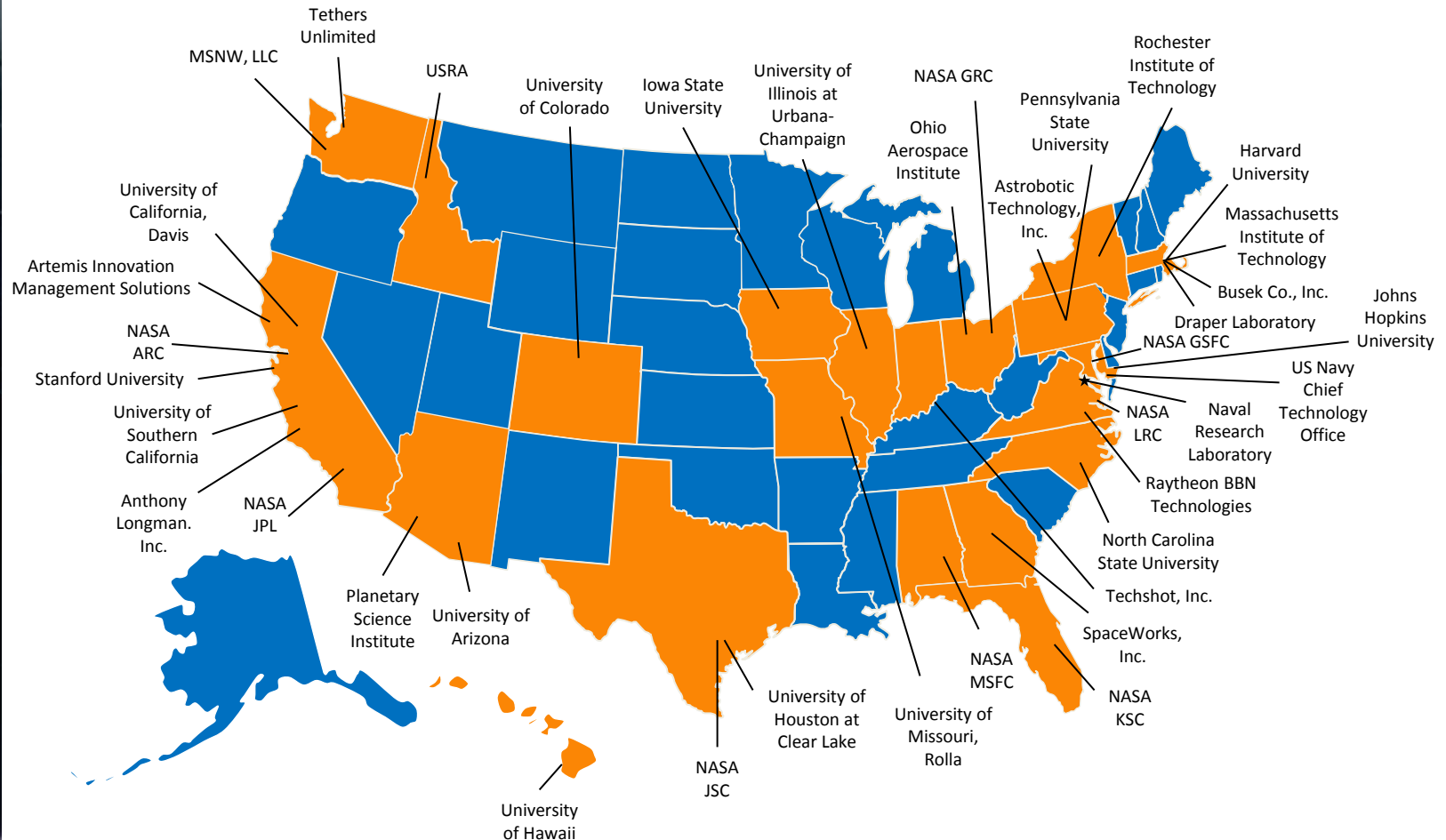
- **Dr. Frank Martin – NEC Chair**
President, Martin Consulting; former NASA
- **Dr. Penny Boston**
Prof. of Cave & Karst Science, New Mexico Tech
- **Dr. David Brin**
Scientist, speaker, well-known author, futurist
- **Dr. John Cramer**
Prof. of Physics, Univ. of Washington, and author
- **Dr. Frank Drake**
Astronomer, Astrophysicist, father of SETI
- **Dr. Michael Yarymovych**
Pres., Sarasota Space Assoc.; former USAF Chief Scientist
- **Dr. Laurence Young**
Apollo Prof. of Astronautics & HST, MIT
- **Ariel Waldman**
Founder of SpaceHack.org and Science Hack Day



The Greater NIAC Community



NIAC: Funding Innovation across the Nation



Communications & Outreach

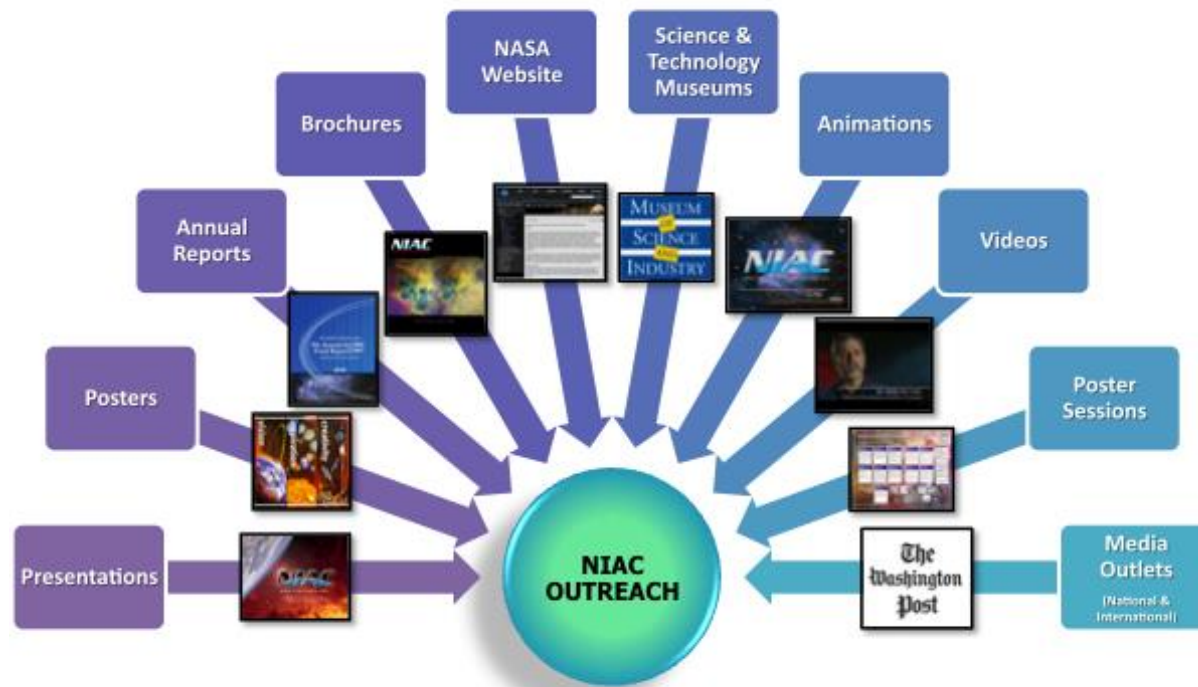
We encourage communication and sharing

Between Fellows and with NASA, public, press, and other orgs

Fellow's Symposium presentations and Final Reports are *public*

Posted in pdf format on the NIAC website

Sensitive information can be protected (e.g., separate appendix)



NIAC In The News

Coverage In Hundreds of Media Outlets



Inspiring Wider Benefits:

NIAC's Benefits to the NATION



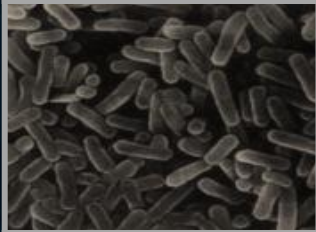
3D PRINTING THE HOME OF THE FUTURE

Emergency Construction for natural disasters, eradicate slums in developing countries



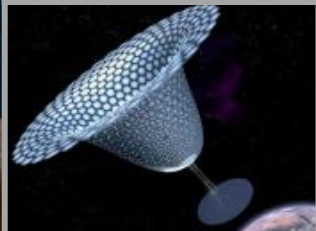
IMPROVING HEALTH WITH SPACESUIT TECHNOLOGY

Medical rehabilitation and physical therapy for those affected by stroke, spinal cord injuries, brain injuries, and the elderly



BACTERIAL BATTERIES

Novel Energy Source: Bacterial Microbes to power microbots



SPACE-BASED SOLAR POWER

Power transmission to Earth during power outages, after natural disasters, to those in remote areas or by the military



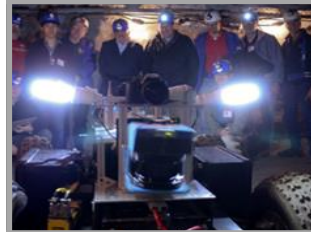
NAVIGATION

Gravitational waves on the atomic level could lead to technology for better steering of military submarines or aircraft



US NAVY Chief Technology Office

NIAC Fellows collaborating with and reporting new NIAC technology research to the CTO



ROBOTICS

Autonomous robots with radar, lasers and other advanced sensors serving as scouts for rescuers responding to underground mine disasters

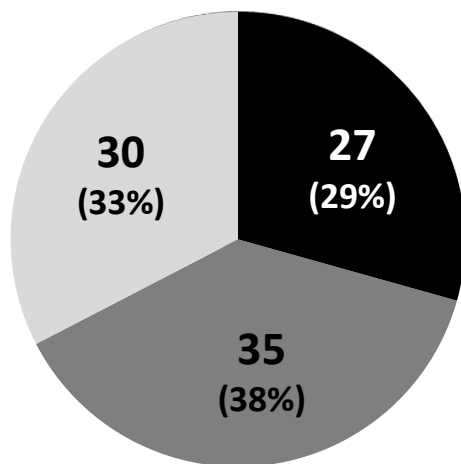


Space Based "X-rays"

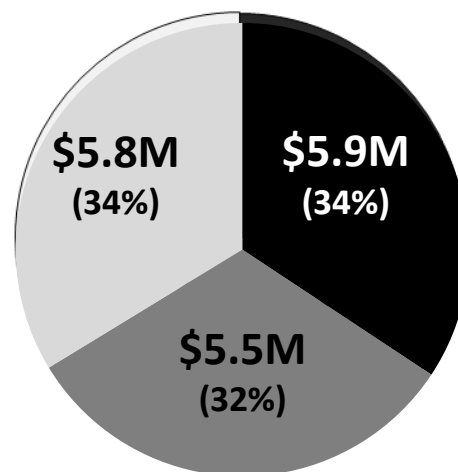
Muon tomography could help planetary defense experts analyze NEO's, with space mining, or to assess volcanic activity and volatility.

A breakdown of total NIAC awards

Number of Awards



Dollars Awarded



Academia
 NASA
 Industry/Other

	Phase I			Phase II		
Awarded	Academia	NASA	Industry/ Other	Academia	NASA	Industry/ Other
FY11	10	11	9			
FY12	3	8	7	3	3	4
FY13	3	5	4	2	1	2
FY14	3	6	3	3	1	1
Total	19	30	23	8	5	7

NIAC Technical Areas of Study

Primary		Secondary		Technology Area:
Phase I	Phase II	Phase I	Phase II	
1	0	4	0	TA01: Launch Propulsion Systems
16	3	2	0	TA02: In-Space Propulsion Technologies
4	0	12	0	TA03: Space Power & Energy Storage
15	4	16	8	TA04: Robotics, Tele-Robotics and Autonomous Systems
1	0	10	4	TA05: Communication & Navigation
8	2	6	0	TA06: Human Health, Life Support & Habitation Systems
3	0	10	4	TA07: Human Exploration Destination Systems
12	3	6	0	TA08: Science Instruments, Observatories and Sensor Systems
2	0	4	0	TA09: Entry, Descent and Landing Systems
1	0	6	6	TA10: Nanotechnology
0	0	4	0	TA11: Modeling, Simulation, IT & Processing
6	4	12	0	TA12: Materials, Structures, Mechanical Systems & Manufacturing
0	0	0	0	TA13: Ground & Launch Systems Processing
0	0	6	0	TA14: Thermal Management Systems
3	0	4	0	TA15: Aeronautics

Primary

In-Space
Propulsion

Robotic
Systems

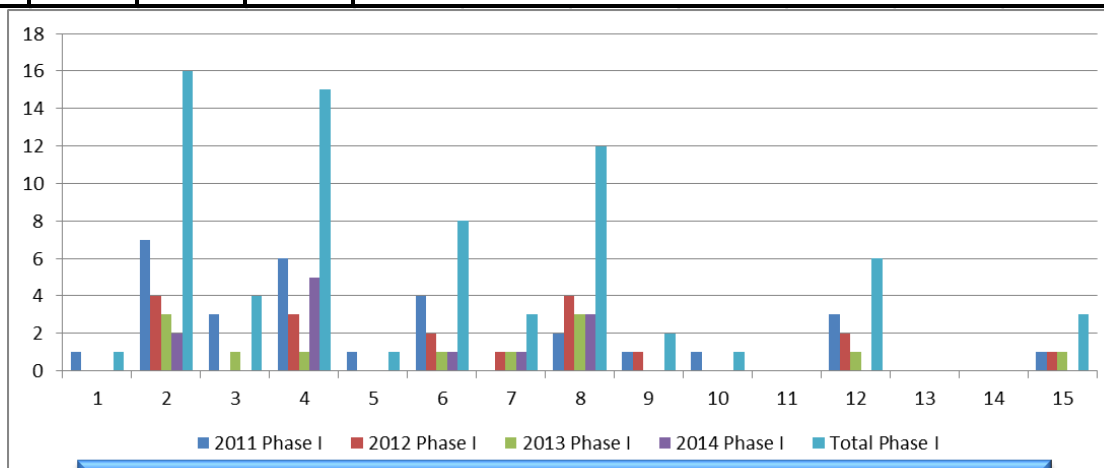
Science
Instruments

Life Support
Systems

Structures

Secondary

Power and
Energy Storage



NIAC Primary Technology Areas by funding year

NIAC and Advanced Propulsion

(1/2)



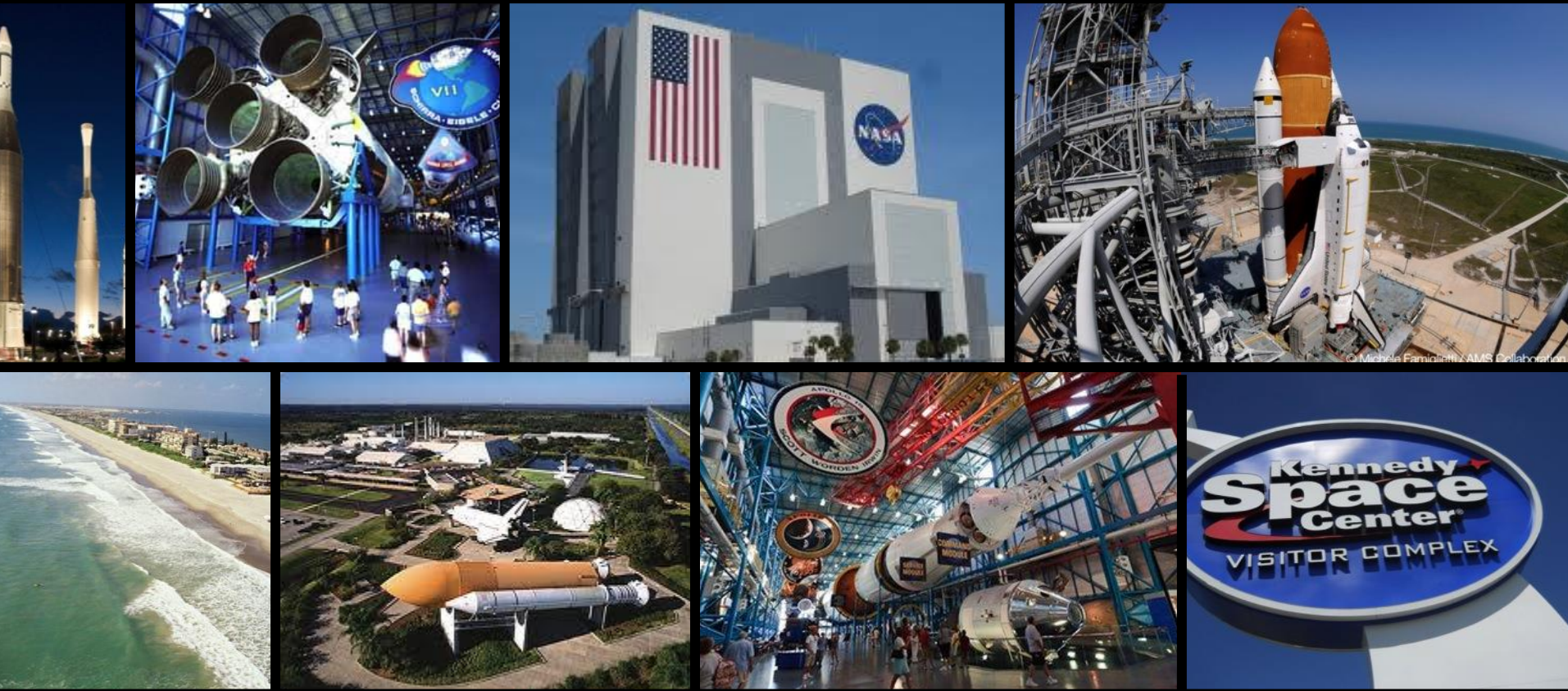
Principal Investigator	Study Title	Organization	Year/Phase
Gilland, James	The Potential for Ambient Plasma Wave Propulsion	Ohio Aerospace Institute	2011 Phase I
Hohman, Kurt	Atmospheric Breathing Electric Thruster for Planetary Exploration	Busek Co. Inc.	2011 Phase I
Sibille, Laurent	In-Space Propulsion Engine Architecture based on Sublimation of Planetary Resources: from exploration robots to NEO mitigation	NASA Kennedy Space Center	2011 Phase I
Silvera, Isaac	Metallic Hydrogen: A Game Changing Rocket Propellant	Harvard University	2011 Phase I
Slough, John*	The Fusion Driven Rocket: Nuclear Propulsion through Direct Conversion of Fusion Energy	MSNW LLC	2011 Phase I
Swartzlander, Grover	Steering of Solar Sails Using Optical Lift Force	Rochester Institute of Technology	2011 Phase I
Tarditi, Alfonso	Aneutronic Fusion Spacecraft Architecture	University of Houston at Clear Lake	2011 Phase I
Werka, Robert	Proposal for a Concept Assessment of a Fission Fragment Rocket Engine (FFRE) Propelled Spacecraft	NASA MSFC	2011 Phase I
Hoyt, Robert	NanoTHOR: Low-Cost Launch of Nanosatellites to Deep Space	Tethers Unlimited, Inc.	2012 Phase I
Kirtley, David	A Plasma Aerocapture and Entry System for Manned Missions and Planetary Deep Space Orbiters	MSNW, LLC	2012 Phase I
Lantoine, Gregory	MAGNETOUR: Surfing Planetary Systems on Electromagnetic and Multi-Body Gravity Fields	NASA JPL	2012 Phase I
Nosanov, Jeffrey	Solar System Escape Architecture for Revolutionary Science (SSEARS)	NASA JPL	2012 Phase I

NIAC and Advanced Propulsion (2/2)



Principal Investigator	Study Title	Organization	Year
Adams, Rob	Pulsed Fission-Fusion (PuFF) Propulsion System	NASA Marshall Space Flight Center	2013 Phase I
Jerred, Nathan	Dual-mode Propulsion System Enabling CubeSat Exploration of the Solar System	Universities Space Research Association	2013 Phase I
Rovey, Joshua	Plasmonic Force Propulsion Revolutionizes Nano/PicoSatellite Capability	University of Missouri, Rolla	2013 Phase I
Ono, Masahiro	Comet Hitchhiker: Harvesting Kinetic Energy from Small Bodies to Enable Fast and Low-Cost Deep Space Exploration	NASA JPL	2014 Phase I
Wiegmann, Bruce	Heliopause Electrostatic Rapid Transit System (HERTS)	NASA MSFC	2014 Phase I
Bae, Young	Propellant-less Spacecraft Formation-Flying and Maneuvering with Photonic Laser Thrusters	Y.K. Bae Corporation	2013 Phase II
Slough, John	The Fusion Driven Rocket: Nuclear Propulsion through Direct Conversion of Fusion Energy	MSNW LLC	2012 Phase II

The 2015 NIAC SYMPOSIUM will be held in:



COCOA BEACH, FLORIDA

January 27-29, 2015
(NEC Meeting on January 30, 2015)

The Future Possibilities Depend on You

NIAC is the most open-ended and far-reaching of
NASA's new technology programs

This exciting program is open to *anyone* in the US
(international researchers may team, but no exchange of funds)



NIAC